

CLAIMS

We claim:

1. A method for recording data transmitted to a storage system, the storage system having a cache and at least one storage device, the data comprising initial data items and additional data items, wherein the initial data items are transmitted to the storage system prior to a moment in time, and the additional data items are transmitted to the storage system after the moment in time, the method comprising:

receiving, by the cache, data transmitted to the storage system;

flushing, from the cache to the at least one storage device, one or more of the initial data items;

receiving, by the cache, one or more additional data items, while at least one of the initial data items is flushed from the cache; and

recording the initial data items.

2. The method of claim 1, wherein the cache comprises non-volatile memory.

3. The method of claim 1, wherein the cache comprises volatile memory.

4. The method of claim 1, wherein initial data items and additional data items are received from a single client server.

5. The method of claim 1, wherein initial data items and additional data items are received from a plurality of client servers.

6. The method of claim 1, wherein the at least one storage device is a block-level storage device.

7. A method for recording data transmitted to a storage system, the storage system having a cache and at least one storage device, the data comprising data items transmitted to the storage system, the method comprising:

receiving data items by the cache;

inserting a marker into the cache, wherein the marker is an indication that one or more of the data items received by the cache are to be recorded; and

recording the one or more of the data items.

8. The method of claim 7, further comprising flushing from the cache the one or more of the data items, prior to the recording of the one or more of the data items.

9. The method of claim 8, further comprising flushing the marker from the cache, prior to the recording of the one or more of the data items.

10. The method of claim 9, further comprising flushing the one or more of the data items prior to the flushing of the marker.

11. The method of claim 7, wherein the one or more of the data items are received by the cache prior to the insertion of the marker into the cache.

12. The method of claim 7, wherein the cache comprises non-volatile memory.
13. The method of claim 7, wherein the cache comprises volatile memory.
14. The method of claim 7, wherein the data is transmitted to the storage system over a network.
15. The method of claim 14, wherein the cache receives data items and flushes data items on a first-in-first-out basis.
16. The method of claim 14, wherein the network is a WAN.
17. The method of claim 14, wherein the network is a LAN.
18. The method of claim 14, wherein the network is a Fibre-Channel-based SAN.
19. The method of claim 14, wherein the network is an internet.
20. The method of claim 14, wherein the network is an intranet.
21. The method of claim 7, wherein the at least one storage device is a block-level storage device.

22. A method for recording data generated by a client server and transmitted to a storage system, the method comprising:

storing data, received from the client server, in the storage system;  
receiving a command from the client server to perform a snapshot of the data; and  
generating a snapshot of the data stored in the storage system in response to the command.

23. The method of claim 22, wherein the command is transmitted in accordance with SCSI protocols.

24. The method of claim 23, wherein the command comprises instructions contained in a SCSI command descriptor block.

25. The method of claim 22, wherein the client server communicates with the storage system over a network.

26. The method of claim 25, wherein the network is a WAN.

27. The method claim 25, wherein the network is a LAN.

28. The method of claim 25, wherein the network is a Fibre-Channel-based SAN.

29. The method of claim 25, wherein the network is an internet.

30. The method of claim 25, wherein the network is an intranet.
31. The method of claim 22, wherein the command is received periodically.
32. The method of claim 22, wherein the command is received aperiodically.
33. The method of claim 32, wherein the command is received prior to and in association with a data processing operation.
34. The method of claim 33, wherein the data processing operation comprises synchronizing two storage systems.
35. A method for recording data generated by a client server and transmitted to a storage system, the method comprising:
  - transmitting data to a storage system for storage;
  - generating a command to perform a snapshot of the data stored by the storage system;
  - and
  - transmitting the command to the storage system to perform a snapshot of the data.
36. The method of claim 35, wherein the command is transmitted in accordance with SCSI protocols.

37. The method of claim 36, wherein the command comprises instructions contained in a SCSI command descriptor block.

38. The method of claim 35, wherein the client server communicates with the storage system over a network.

39. The method of claim 38, wherein the network is a WAN.

40. The method claim 38, wherein the network is a LAN.

41. The method of claim 38, wherein the network is a Fibre-Channel-based SAN.

42. The method of claim 38, wherein the network is an internet.

43. The method of claim 38, wherein the network is an intranet.

44. The method of claim 35, wherein the command is transmitted periodically.

45. The method of claim 35, wherein the command is transmitted aperiodically.

46. The method of claim 45, wherein the command is transmitted prior to and in association with a data processing operation.

47. The method of claim 46, wherein the data processing operation comprises synchronizing two storage systems.

48. A system for recording data transmitted to a storage system, the data comprising initial data items and additional data items, wherein the initial data items are transmitted to the storage system prior to a moment in time, and the additional data items are transmitted to the storage system after the moment in time, wherein the storage system comprises:

a cache for receiving data transmitted to the storage system, for flushing one or more of the initial data items to the at least one storage device, and for receiving one or more additional data items while flushing at least one of the initial data items; and

a controller for recording the initial data items.

49. The system of claim 48, wherein the cache comprises non-volatile memory.

50. The system of claim 48, wherein the cache comprises volatile memory.

51. The system of claim 48, wherein initial data items and additional data items are received from a single client server.

52. The system of claim 48, wherein initial data items and additional data items are received from a plurality of client servers.

53. The system of claim 48, wherein the at least one storage device is a block-level storage device.

54. A system for recording data transmitted to a storage system, the data comprising data items transmitted to the storage system, wherein the storage system comprises:

a cache for receiving data items; and

a controller for inserting a marker into the cache, wherein the marker is an indication that one or more of the data items received by the cache are to be recorded, and for recording the one or more of the data items.

55. The system of claim 54, wherein the cache flushes the one or more of the data items prior to the recording of the one or more of the data items.

56. The system of claim 55, wherein the cache flushes the marker prior to the recording of the one or more of the data items.

57. The system of claim 56, wherein the cache flushes the one or more of the data items prior to the flushing of the marker.

58. The system of claim 54, wherein the cache receives the one or more of the data items prior to the insertion of the marker into the cache.

59. The system of claim 54, wherein the cache comprises non-volatile memory.



- 60. The system of claim 54, wherein the cache comprises volatile memory.
- 61. The system of claim 54, wherein the data is transmitted to the storage system over a network.
- 62. The system of claim 61, wherein the cache receives data items and flushes data items on a first-in-first-out basis.
- 63. The system of claim 61, wherein the network is a WAN.
- 64. The system of claim 61, wherein the network is a LAN.
- 65. The system of claim 61, wherein the network is a Fibre-Channel-based SAN.
- 66. The system of claim 61, wherein the network is an internet.
- 67. The system of claim 61, wherein the network is an intranet.
- 68. The system of claim 54, wherein the at least one storage device is a block-level storage device.

69. A system for recording data generated by a client server and transmitted to a storage system, comprising:
- a memory for storing data, received from the client server, in the storage system; and
  - a controller for receiving a command from the client server to perform a snapshot of the data, and for generating a snapshot of the data stored in the storage system in response to the command.
70. The system of claim 69, wherein the command is transmitted in accordance with SCSI protocols.
71. The system of claim 70, wherein the command comprises instructions contained in a SCSI command descriptor block.
72. The system of claim 69, wherein the client server communicates with the storage system over a network.
73. The system of claim 72, wherein the network is a WAN.
74. The system claim 72, wherein the network is a LAN.
75. The system of claim 72, wherein the network is a Fibre-Channel-based SAN.
76. The system of claim 72, wherein the network is an internet.

77. The system of claim 72, wherein the network is an intranet.
78. The system of claim 69, wherein the command is received periodically.
79. The system of claim 69, wherein the command is received aperiodically.
80. The system of claim 79, wherein the command is received prior to and in association with a data processing operation.
81. The system of claim 80, wherein the data processing operation comprises synchronizing two storage systems.
82. A system for recording data stored in a storage system, comprising:  
a client server for generating data, for transmitting the data to a storage system for storage, for generating a command to perform a snapshot of the data stored by the storage system, and for transmitting the command to the storage system to perform a snapshot of the data; and  
a storage system for receiving the data from the client server, for receiving the command from the client server, and for performing the snapshot of the data in response to the command.
83. The system of claim 82, wherein the command is transmitted in accordance with SCSI protocols.

84. The system of claim 83, wherein the command comprises instructions contained in a SCSI command descriptor block.

85. The system of claim 82, wherein the client server communicates with the storage system over a network.

86. The system of claim 85, wherein the network is a WAN.

87. The system claim 85, wherein the network is a LAN.

88. The system of claim 85, wherein the network is a Fibre-Channel-based SAN.

89. The system of claim 85, wherein the network is an internet.

90. The system of claim 85, wherein the network is an intranet.

91. The system of claim 82, wherein the command is transmitted periodically.

92. The system of claim 82, wherein the command is transmitted aperiodically.

93. The system of claim 92, wherein the command is transmitted prior to and in association with a data processing operation.

94. The system of claim 93, wherein the data processing operation comprises synchronizing two storage systems.